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Applicants	:	Tatsuhito TAKAHASHI et al.
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For	:	UNDER WATER IMMERSION BLOCK AND METHOD TO PRODUCE THE SAME
Art Unit	:	1755
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DECLARATION UNDER 37 CFR 1.132

Commissioner for Patents

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SIR:

The undersigned declares as follows:

1. I am a coinventor of the above-identified patent application.

2. I graduated from the University of Tokyo Institute of Technology in the year 1976, and I received the degree of Bachelor.   I received the degree of Doctor in engineering from Tokyo Institute of Technology in the year 1996.

3. I have worked for NKK CORPORATION (now JFE Steel Corporation), Tokyo, Japan, since 1976, and I presently hold the position of staff general manager.

4. The following experiments, which show unexpected results for the presently claimed invention, were carried out under my supervision.

Concerning Table A (Experimental Result)
(How to prepare the marine block)

The marine block of Table A was prepared by using materials, which was basement for creating algae places. The algae places induce seeds and saplings to adhere and live on the surfaces of materials, naturally. The following Experimental Results shows that when the marine blocks were laid in existing algae planting places, marine algae adhered and lived on the surface of the marine blocks within a short period. Further, when the materials with algae living were moved as seeding materials to creating places and at the same time the newly materials (materials algae that did not adhere) were located around their circumstances, the marine algae as seeding materials increased on the circumferential materials. And, units of a community of algae, which has the algae planting places, were formed.

As a raw material of such marine blocks, the slag generated in the steel making process was at first treated in a metal removing treatment for removing the main metal content. At the same time, in the metal recovering process, the steel making slag was pulverized into a grain size of 50 mm or less. In the Experimental Results, the steel making slag was separated into two groups, which were 5-50 mm, and 5 mm or less.

The steel making slag such as the above-mentioned size, where CaO content was 50% and SiO_2 content was 15%, was piled 1 m in a pit of 1 m width x 1 m depth, and moderately tightened. Then the pit was closed and blown with carbon dioxide 0.96 Nm^3/hr for 5.5 days so as to solidify the slag. The carbonation-solidified slag was broken into an appropriate size to produce a lot of pieces of the block materials, which were used for the seeding materials and the basements of the algae planting place. The appropriate size was determined as the following dimension. One was 1mW x 1mL x 1mH for the unit acreage sampling of to observe the growth of algae. And the other was 10 cm W x 10cm L x 2cm H. for observing adhering coral.

Such above-mentioned blocks were transported to the sea of a natural algae planting place, put in a pilling-up net, and was laid in the algae planting place, turning upward the fractured face.

Afterwards, under the conditions described on the bottom part of Table A, the marine blocks were immersed in the seawater for a determined duration.

As a result, the excellent experimental results (Example) were obtained which were distinguished from the Cement Concrete (Comparative Example), and which were clearly different from the Cement Concrete.

Such experimental results are shown in the following Table A.

Table A (Experimental Result)

		Example		Comparative Example	
		Marine Block		**Cement Concrete**	
Main material		Steel making slag		Portland cement Coarse aggregate Fine aggregate	
Component				Portland cement	
	CaO	50%		64%	
	SiO2	15%		22%	
Grain size	>50mm	0%		0%	
	5-50mm	15%		43%	
	<5mm	85%		57%	
Percentage of porosity (%)		Compressive strength(kg/cm2)	Growth of Algae	Compressive strength(kg/cm2)	Growth of Algae
	8	5		260	
	10	30		230	not good
	20	230	good	140	
	30	200	good	80	
	40	100	good	40	
	50	55		–	
	60	40		–	
	70	30		–	
	80	20		–	
Growth of Algae right after immersion after half a year passes		The number of adhering algae none(0 piece) 69 pieces		The number of adhering algae none(0 piece) 3 pieces	
Ahering of Coral	October	The number of adhering individual 67 pieces of individual		The number of adhering individual 29 pieces of individual	

Definition of compressive strength:

Maximam compressive load for specimen to be durable
/
Cross section of the specimen, which is located to vertical direction of the compressive strength
Dimension of the specimen: 10cm diameter * 20cmH

Growth of Algae: Experimental condition
Jyogashima offing, Miura City, Kanagawa Pref.
Depth of water 7m, Ecklonia Place,
Immersion on November
The average number of Ecklonia was observed on the tme of half a year passage after immersion.
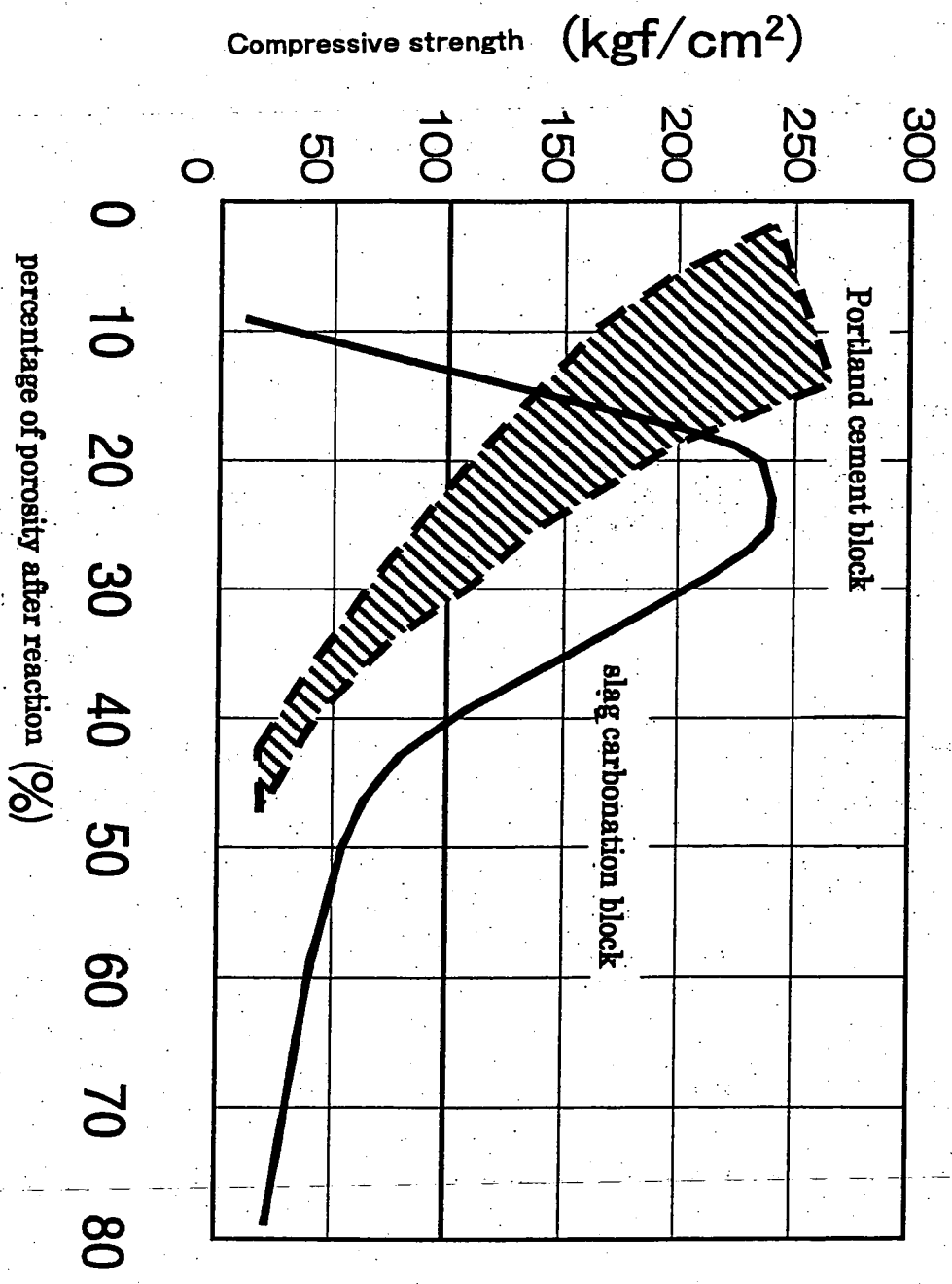–Note)–the average number of Ecklonia (on the top face of the cube, whose dimention is 1mW * 1mL * 1mH)

Adhering of coral: Experimental condition
Okinawa Pref. Immersion on June, Observation on October
Total adhered number of coral polyp (both sides of 15 pieces of plate, which is equivallent to 30 faces. Dimension of each plate is 10cmW * 10cmL * 2cmH.)

Table B   Comparison concerning compressive strength
between the porous concrete and the marine block

Compressive strength   (kgf/cm²)

300
250
200
150
100
50
0

Portland cement block

slag carbonation block

0   10   20   30   40   50   60   70   80

percentage of porosity after reaction (%)

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true ; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment , or both , under Section 1001 , of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon .

Date: _February 4, 2004_ By: _Tatsuhito Takahashi_
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